

MSDS 413, Summer 2019, Assignment 3 Forecasting - Fundamental Concepts (TS3)

Introduction

Consider the monthly series of Consumer Sentiment of the University of Michigan. This survey series is widely used to indicate the consumer confidence about the U.S. economy. The data are available from FRED of the Federal Reserve Bank of St. Louis and also in the file m-umcsent.txt. The sample period is from January 1978 to August 2013.

The following list defines the variables:

- year is the year the data were collected
- mon is the month the data were collected
- day is the day the data were collected
- VALUE is the measure of consumer confidence in the U.S. economy

Your objective is to explore the time series behavior of the sentiment data.

Procedure

The following steps are necessary to complete this assignment. Address each and every part and ensure that you cover all the details specified in the questions.

1. **EDA** (1 point) Conduct an EDA on the monthly series of Consumer Sentiment of the University of Michigan. Are there unit roots and if so, why?
2. **First differencing** (1 point)
 - 2.1. For the rate of change (first difference) series of the sentiment data, test the hypothesis that the expected change of sentiment is zero versus the alternative that the expected change is non-zero. Interpret.
 - 2.2. Test the null hypothesis $H_0 : \rho_1 = \rho_2 = \dots = \rho_{12} = 0$ versus the alternative $H_a : \rho_i \neq 0$ for some $i \in [1, 12]$ autocorrelation coefficients. Explain your findings.
3. **AR model of the first difference data** (2 points)
 - 3.1. Build an AR model based on the selected order for the change series. Write out the fitted model equation.
 - 3.2. Perform model checking to validate the fitted model. Interpret the diagnostics.
 - 3.3. What are the business cycles in consumer sentiment? What do they mean?

- 3.4. Obtain 1-step to 4-step ahead points with 95% interval forecasts for the first difference series of consumer sentiment with the forecast origin August 1, 2013 (the last observed data point).
4. **More AR modeling** (2 points)
- 4.1. Simplify the fitted *AR* in part 3 by removing parameter estimates with *t*-ratios less than absolute value 1.2 using the **fixed** option. Write the fitted model equation.
- 4.2. Is the model adequate? Why?
- 4.3. Compare the simplified model with the *AR* model built in part 3. In terms of in-sample fitting, which model is preferred? Why?
- 4.4. What are the simplified model business cycles? Are they different from the model in part 3?
- 4.5. Use **backtest** to compare the two *AR* models. You may start the forecast origin at $t = 380$. Which model is preferred? Why?
5. **Report** (1.5 points) Choose the “best” model from the parts above. Write an executive report with information from the analysis from which decisions or actions can be made.

Deliverables

See Section Submission Directions below. The assignment deliverables, each in pdf format, are as follows:

- *Only if requested by instructor*
 - The program or script
 - Logs
 - Outputs
- **Mandatory**
Data analysis write-up: no programs, logs, or just code outputs.

The data analysis must follow and use the item numbering of each assignment, i.e., use the numbers, say, 1 - 5, with the sub-lettering if used. These deliverables are provided according to the instructions in the Submission Directions section below.

Submission Directions

Title Page

Include a title page with your name and the assignment designation. Leave room for instructor comments.

File Names

The assignment write-up file shall be submitted to Canvas according to the schedule in the syllabus using the item (1) naming convention below. The naming convention is case sensitive. Use letters and numbers as given. **The file name parts have no spaces or other separator characters.** TS3Lastname.pdf (submit via Canvas)

The parts are the assignment code, TS3; your lastname with only the first letter capitalized; a period, and lastly, the extension “pdf”. Generically,

TS3Lastname.pdf

For example: Suppose your name is Student McStats. Your filename then is:

TS3Mcstats.pdf

The analysis write-up file must be submitted for grading. Each write-up requires a title page for instructor comments. The analysis may use either R or any other statistics package you wish, or if you use more than one package, you must use the germane tables, plots, etc., in a single report. If you use more than one package, differences and similarities should be indicated.

email: jamie.riggs@northwestern.edu

Email *ONLY IF REQUESTED* the program (script), log and output as separate pdf files. The R log and output may be combined. The file names shall be as follows:

- The program or script file names
 - TS3LastnameRprog.pdf
- The log file names
 - TS3LastnameRlog.pdf